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During the late 1960's and early 70's a variety of environmental/energy oriented legislation was enacted by the Congress. The most important of these acts, the National Environmental Protection Act (NEPA), required that environmental impact statements be filed when various private and public activities have a potential for impacting man and his environment. (17) Impact statement requirements go beyond the currently practiced cost/benefit analysis, which is often just a production (direct) impact assessment. Heretofore, indirect or second round economic and social effects of consequence affecting other national goals were seldom counted.

Impact analysis of the type specified in Sec. 102(c) is not required of legislation however. The NEPA does not require such analysis, yet often the legislation will have an impact on "man and his environment." The passage of the Clean Air Act of 1970 is an example. It initially triggered a low key demand for cleaner fuels and/or emission cleaners. Since the states were required to submit implementation plans to the Administrator of the Environmental Protection Agency, many states took the option of requiring stricter controls than the national standards. These individual state actions, however, may have national energy supply consequences. The aggregate requirements of states, each acting alone, could result in uncoordinated public and private sector activity.*

It is our intention in this paper to examine such manifestation of policy incrementalism in environmental/energy planning in the public sector. Incremental decision making presents problems because it does not focus attention on a clearly defined issues.

> ...There is no one decision and problems are not "solved"; rather there is a "never-ending series of attacks" on issues at hand through successive or serial analysis and policy making. The incremental approach is deliberately exploratory. Rather than attempting to foresee all the consequences of various alternative routes, one route is tried, and the unforeseen consequences are left to be discovered and treated by subsequent increments. Even the criteria by which increments are evaluated are developed and adapted in the course of action. (8)

Incremental decision making has led to property right (formal and informal) changes without consideration of impacts in the socio-economic sense.** Such considerations will be explored in this paper and an approach will be offered to explore the potential of policy action for disruptive change.

A CASE IN POINT: WESTERN COAL AND EASTERN CLEANER AIR

Under the Clean Air Act of 1970 (P.L. 91-604), air quality standards were established for the entire country. However, if a particular state has more stringent standards, the local regulation will take precedence.(4) Some of the energy supply planning implications of these statutory conditions are problematic.

One of the major emissions to be restricted and controlled are sulfur oxides (SO_x). It is estimated that by June 30, 1977, if P.L. 91-604 were not implemented, 64 percent of all SO_x emissions would be generated by steam electric facilities.(22) By 1977, it is additionally projected that total annual damage cost could be about $14 million for uncontrolled SO_x emissions. Over 90 percent of this damage would result from stationary sources, most of which are steam electric plants.

Control of these emissions, through P.L. 91-604 and the state implementation plans, is feasible by two modes: flue gas desulfurization or use of low sulfur fossil fuels. The latter approach can be used to illustrate the potential problems of incrementalism. Steam electric plants usually can burn either fuel oil or coal with a minimum of conversion effort. This "relative" mechanical ease of fuel switching may result in severe market disruption as utilities attempt to secure a fuel supply. Normally, purely economic decisions at the firm level will determine if low sulfur coal or oil is burned, but under the Federal Energy Supply and Environmental Coordination Act of 1974, utilities may be directed to burn either fuel (in fact, this occurred in June, 1975).(9,13)

Previously, during the 1973 Arab oil embargo, many utilities switched from oil to coal. In many cases, exemptions were given from state clean air standards. From November, 1974 to April, 1975 at least 13 coal burning plants in the Northeast were converted back to oil because of the loss of state-granted exemptions.(18) Concurrently the fuel adjustment charge to customers allowed the higher oil cost to be passed on to the consumer. Due to the Federal Energy Administration's (FEA) order to convert back to coal, new pressure on coal supplies (especially low sulfur) can be expected in the future.

The current status of domestic coal supplies appears to be in a state of flux. Large reserves of western coal appear to be the prime candidates for expanded production. In 1973, the Secretary of Interior stopped all further coal leasing on western lands pending completion of an environmental impact statement (EIS) on the Federal coal leasing policy.(27)

The EIS has become one of a number of opinions, briefly listed below, on the advisability of developing Federal western coal. This debate coupled with the history outlined above reflects the disadvantage of incrementalism in public sector energy decisions and environmental planning as well as the long term adverse impact potential of the current series of private incremental decisions. Of course both sectors often act in concert, either jointly or in reaction to one another. This supply debate appears to center on two major issues: (1) the advisability of large changes in coal supply sources, and (2) the socio-economic environmental impacts of developing new supplies.

With regard to developing new supply sources, the Department of Interior's Final Environmental Impact Statement for the Proposed Coal Leasing Program essentially concludes that renewed Federal coal leasing is necessary to meet the Nation's energy needs.(26) However, in the same report it is stated that "there is enough coal under lease to last 118 years at the rate

*Optimal public sector activity would be defined here as that which took cognizance of any designed policies for accounting of social and economic impacts, both short and long term.

**Property rights are defined as sets of order relationships among people which define their rights, exposure to the rights of others, privileges and responsibilities.

of production predicted for the year 2000".(26) In a separate document authored by the same agency, it is also argued that existing leases may not be adequate to meet the Nation's energy needs.(23)

Public critique of the Federal coal leasing may best be summed up by the following statement from the Ford Foundation Energy Policy Project: "...given the huge amounts of coal under lease, little of which is being mined, no apparent need exists for a major new thrust in coal leasing before 1980...".(7)

The Council on Economic Priorities echoed similar concerns in a report on coal leasing of Federally controlled lands.(1) The major points revolved around what needs to be done to improve currently practiced coal lease management.

The Environmental Impact Assessment Project of the Institute of Ecology, in its critique of the Department of Interior EIS, raises the issue of supply need in another form: What is the comparative need for new coal supplies in relation to existing or currently developing supplies east of the Mississippi?(6) Quoting a Bureau of Land Management study, they note that some 77 billion tons of less than 1 percent sulfur coal is centered on the eastern Kentucky, southern West Virginia and western Virginia area.(23) An industry publication cites a lower figure of some 55 billion tons existing as of January, 1974 for that area.(2)

The question of how much western, and particularly Federally leased, coal will be needed to meet national energy demands remains unresolved. In responding to technical criticism, the Department of the Interior indicated that it was not the purpose of a programmatically conceived EIS to consider the quantity of coal mined under the leasing program. Although effective research may require that problems be broken into manageable pieces and simplified, this process may preclude whole sets of policy issues and management options, and sets the stage for dependence on incremental planning.

Western coal development augurs tremendous socioeconomic and environmental changes for areas such as the Northern Great Plains. Some of these would be short term resulting from the boom-town atmosphere of construction of coal related facilities, while others would be longer term. The latter would range from significant changes in the rural character of the social economy to a rehabilitation of land and water resources. The initial resource changes may become irreversible, however. The potential impacts include the following:

1. water shortages
2. aquifer disruption
3. reclamation impacts on the eco-system
4. regional climatic change
5. toxic and carcinogenic trace element release
6. air degradation
7. scientific and cultural resource destruction
8. potential permanent loss of agricultural production
9. social/economic problems of boom bust activity

The Department of the Interior's EIS final draft discusses these problems, but critics suggest additional research needs to be conducted. A major criticism relates to the availability and usage of water.

Water is as scarce a resource in the west as coal is abundant. Both surface and groundwater regimes are threatened from coal development. Mining, reclamation, dust control, and the associated coal resources which are exploited for western energy use, i.e., on-site coal conversion (generation, gasification, liquefaction), will require even more massive amounts of water.

The usage of surface water in this region has traditionally gone "to the one who is first in time of whether the water is used upon land contiguous to the source of supply or far removed from it".(12) However, the ownership rights of groundwater do not have the long and well defined legal history surrounding surface water rights. This will be critical since many western coal seams also act as aquifers. According to Davis, some western states have recently adopted codes for underground water which are essentially identical to those for surface water use. One appropriates the water and secures approval from a state authority. "A quantity used is determined by state authority, but the well may be shut down if it imperils a neighbor's supply or higher priority uses necessitate the water elsewhere".(5) On the latter, a case can be made for compensation. In any event the property right conflicts among coal and other water users need to be analyzed.

Another area of controversy is the reclamation of strip mined lands. According to the EIS critique, "successful reclamation of coal strip mines has occurred nowhere in the Southwest, Rocky Mountain or Northern Great Plains states".(6) However, a recent USDA/Forest Service study concludes:

> almost all the surfaced-mined lands of the Northern Great Plains can be rehabilitated successfully...a large amount of basic information needs to be collected, and numerous research problems require solutions before such rehabilitation can proceed expeditiously, effectively and economically.(21)

Another study by the National Academy of Science indicated that reclamation is not feasible where rainfall is less than 10 inches per year and the soils cannot retain moisture.(16) A number of areas in the Northern Great Plains region appear amenable to successful reclamation, but to what degree of success? These are still large unanswered questions.

All of these environmental impacts if the critics are correct, are negative enough by themselves but they are also the power train for direct and indirect, short and long term socioeconomic impacts of considerable magnitude. Although the EIS does provide descriptive data on the regional economics involved, critics argue that an extensive regional economic analysis demonstrating distributive effects is required as a critical link in beginning a valid social impact assessment. In turn the social impact questions would include land use, population patterns, public service provision/complexion, and human value conflicts.

To lend credence to the EIS critique's statement that "the social fabric would be altered in every respect by the incursion of coal development", a quick analysis of the regional economy of the Northern Great Plains coal leasing area is instructive. The following material is from the U.S. Water Resources Council OBERS estimates.(28) In four of the five water resources subareas (Tongue-Powder, Lower Yellowstone, Missouri-Little Missouri, Cheyenne, and Missouri-Oahe), over 30 percent of total earnings by employees in the primary or basic industries, accrued from agriculture. Some 65 percent of the Federal land in this area is used for livestock grazing. Non-agricultural activity is confined mainly to food processing, contract

construction and wood using industry. In the case of the Wyoming area (major part of Tongue-Powder and one-third of Cheyenne), 28 percent of the State's cattle and calves and 42 percent of the sheep are raised in that area. About 20 percent of the State's wheat and oat crop is harvested in that region.(30) In essence then, if an incursion from massive coal development occurs in this area, it will result in a tremendous change in the complexion of the agrarian economy. This change into quick industrialization will include concomitant support industries and associated urbanization to accommodate an influx of workers and their families.

This is not to say this change in the economy is a good or a bad. Nevertheless, it is an exogenous change that is impacting the regional culture and its effects need to be evaluated. The short term consequences of this change may be mitigated through a compensation procedure for those who lose their agricultural livelihood, although neither the EIS nor its critique discussed this point. In the long run, this agricultural production may be lost forever. Although this region is not as productive as others, the possibility of an irreversible loss of agricultural production is a significant one for our future. This is not the only place where strip mining is affecting agriculture. In Illinois, where the land is much easier to reclaim, not all agricultural productivity has been reclaimed from strip mining.(11) Much of that former crop land has been reclaimed only to pasture land. By controlling the amount of strip mining today, we are preserving future options in an energy source/food source trade-off. New strip mining and reclamation technologies may be available then to better facilitate both needs.

Krutilla has an instructive statement on this very point of irreversibility and early consumption which is not conventionally met in resource economics.

> At any point in time characterized by a level of technology which is less advanced than at some future date, the conversion of the natural environment into industrially produced private goods has proceeded further than it would have with the more advanced technology. Moreover, with the apparent increasing appreciation of direct contact with natural environments, the conversion will have proceeded further, for this reason as well, than it would have were the future composition of tastes to have prevailed. Given the irreversibility of converted natural environments, however, it will not be possible to achieve a level of well-being in the future that would have been possible had the conversion of natural environments been retarded.(14)

To conclude this presentation of the controversy, one more broad socioeconomic impact needs to be addressed. If in fact low sulfur reserves are available in the east, and the western coal development occurs, the potential exists for large shifts in regional coal production from the east to the west. While some coal/utility companies may in fact be considering the possibility of a shift in coal supply source, others are planning to open 123 new mines over the next eight years, 78 of which are in the low sulfur region of eastern Kentucky and southern West Virginia.(2) Deep mines continue to open up, the industry is making training progress and it appears to be recovering from the trauma of the Federal Coal Mine Health and Safety Act of 1969.(3) In essence, while eastern and mid-western coal fields continue to expand, the prospect of apparently cheap western coal portends and excess supply situation. This would impact the established infra-structurer of eastern producing communities.

PROJECT INDEPENDENCE

No discussion such as this can ignore the need to consider other related policy options. The previous case in point is part of an even bigger energy/environment management problem. As alluded to earlier, the availability of fuel oil at various prices is of utmost importance to the coal supply/SO_x emissions problem. Of course, the new national goal of independence from foreign energy sources by 1980 (or security by 1985 as it now is envisioned) interjects a new facet to the dilemma.

One of the three options in the FEA's Project Independence report is to increase domestic supply. However, "accelerating domestic supply has the drawbacks that: (1) it will adversely affect environmentally clean areas, (2) it requires massive regional development in areas which may not benefit from or need increased supply, (3) it is a gamble on yet unproved reserves of oil and gas, and (4) it may well be constrained by key materials and equipment shortages".(19) The statement applies generally to all fossil fuels. An exemplary problem is suggested by examining the implications of the prospect of an increase in the mix of energy supply sources, with coal replacing fuel oil to a significant degree.

> To achieve even this kind of an energy future would require federal actions not yet taken. The most important of these are: modifying the Clean Air Act to permit more widespread use of high sulfur coals than the present statute allows....(19)

THE DECISION-MAKING PROCESS

The point of the above discussion is not to try to establish the truth or adequacy of any of the Federal policy statements or their criticisms. Rather, it is to point out that the energy issue is a broad problem with many facets and many decision makers. Further, none of these decision makers have all the facts they need, and in general only the Federal Government has sufficient authority to weigh all the effects of proposed changes.

The danger in such a situation is that incremental decision making--decisions over time by various private, state, and Federal agencies about small parts of the problem--will gradually preclude options for the long run, and even create crisis short run situations. In fact, the potential of irreversible consequences may emerge in an institutional as well as a physical environmental sense, where an accumulation of small decisions in period t become interlocked to form rigid irrevocable assumptions for policy decision in t+n periods.

Part of the problem is the result of specific institutional conditions in a multi-interest decision field. Each decision entity attempts to establish a distinctive domain* of responsibility in order to minimize outside interference with their operations. Thus, an executive agency will extend domain claims no farther than top level administrators perceive substantial constituency support to be available. In practice, this means an agency's decision makers will generally leave the agency a conservative margin of error, thereby,

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*Domain refers to the "bundle" of responsibilities service organizations claim as their distinctive field of operation. Domain encompasses a specific target population (direct beneficiaries), a set of problems to be addressed, and specific services or intervention measures to be applied.(15)

interpreting the agency's legal mandate as narrowly as possible in order to minimize conflict with constituency elements and other agencies.

Narrowly defined public responsibility and literal adherence to the statutory mandates are characteristic behavior when an agency finds itself in "fringe areas". Traditional cost-benefit analysis has been regarded as an "objective tool" which permits decision independent of value judgments. In fact, we argue it is seldom value-free. The assumptions made in defining the very scope of the problem to be analyzed often, unintentionally, introduce value judgments.

Generally speaking, environmental/resource problems are so complex that, at a minimum, the analysis must be conducted at a comparative program level as well as an intra-program level before sufficient foresight for the contemplated intrusion into the private sector can be generated. Typically, evaluation is conducted only at one level, i.e., alternative classes of options that enhance "nontarget" benefits are seldom fully evaluated. Such narrow decision making conceived in the name of expedience and efficiency may bring the decision makers to an upper limit of intervention choices rather quickly, i.e., the point at which the next best option, (e.g., use of the land) will yield a zero or negative cost-benefit ratio*. When this threshold is reached, time is truly of the essence, because the decision to confine the focus to marginal decision making may preclude the possibility of a whole class (level) of beneficial decision options; e.g., development of socially suitable technologies. Where this mode is dominant in an agency, it may result in societal and environmental decisions with irreversible consequences.

TOWARD A SOLUTION

Solutions to this dilemma do not come easily. Decision tree analysis and similar decision aids will help one to systematize the levels of decision, information needs and options. However, the problem, we should emphasize, is not a technical/logistical one. A lasting solution to the problem is one that requires the generation of an institutional atmosphere for decision making and analysis that will permit proper integration of policy making and support activity, i.e., multi-level impact analysis. This is not a problem that can be wished away or easily side-stepped with a new analytic or methodological wrinkle. Solutions are available but they will not be achieved without adversary pressure.

The achievement of suitable decision conditions will not require major innovations of an analytic nature. Refinement of cost-benefit analysis to permit pricing of heretofore unpriced externalities and other secondary effects, plus extension of this analysis to a consideration of sociological and social psychological parameters are desirable innovations. Such extensions are under development and are commonly being subsumed under the rubric--social or socioeconomic impact analysis (SIA).(10,20,29)

We do not mean to minimize the theoretical and methodolotical difficulties associated with the task of tracing the technological/natural resource related policy intrusions to changes in property rights and social arrangements (SIA). To the contrary, we merely wish to point out that this is not the major aspect of the problem. As we have suggested, the major hurdle to constructive social policy in this area is the institutional context in which analytic procedures for forecasting are employed. We hasten to note, however, that one cannot realistically expect change of the magnitude necessary to move away from incrementalism. It would be more reasonable to think in terms of legislative reforms that would explicitly require each Federal agency to periodically review their domain responsibilities at a program and project level (and ideally at an overall policy level) on the basis of systematic SIA.

The objective of the SIA procedure would be to evaluate progress in major goal areas. Multi-level SIA evaluation will provide the basis then for modifying agency actions where necessary in order to realign activities in accordance with mandated goals and/or to modify direction where subsequent change in the world indicates adjustments in agency goals (and/or domain definitions) are advisable. In the latter case, final decisions may pass out of the agency back to Congress, but there is little about this or other elements of this procedure that are not consistent with present modes of governmental operation. Our recommendation merely recognizes the inherent limitations of scope and temporal perspective (both retrospectively prospectively) associated with conventional analysis.

Multi-level SIA conducted on a periodic basis would be most efficiently accomplished by modifying and expanding existing monitoring and evaluation programs to attain an ongoing SIA capacity. This will provide a much needed flexibility and reality testing in public policy that is sorely needed in the resource/environment policy as well as other areas of social policy. Moreover, if Congressional appropriations were explicitly tied to the efficiency of these systems in terms of both long and short term savings of public funds and/or avoidance of public problems, executive agencies would have ample incentive to apply said evaluation judiciously.

CONCLUSION

The dangers of incrementalism in macro-planning are perhaps most pronounced in the long run as marginal decision-making becomes the basis for assumptions in the longer time frame. The energy-environment policy arena has experienced this situation in only six years. The prevailing decision making process has "evolved" from Congressional, Federal agency, state agency, plus strong firm level patterns of operation. We have not seriously challenged the supporting structure of this decision making process. In reality, it is a series of units making fragmented, non-interconnected policy analyses of energy and environmental problems. The dangers of marketplace disruption by ill-conceived public sector incursions are large without some overall planning mechanism for coordination. Multi-level socioeconomic impact assessment is one possible means to this end and short term planning costs appear to be insignificant when compared to longer term risk/costs of energy supply disruption, severe (perhaps irreversible) environmental degradation, and severe socioeconomic dislocation.

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*For a more detailed discussion of the origins and problems of incrementalism and the role of knowledge and analysis in policy making in advanced industrial society see (8). Etzioni distinguishes between rational decisions--marginal decision being a case in point--and incrementalism. The former involves consideration of appropriateness of the goal. Whereas the latter, incrementalism, represents a still more limited time of decision in that a full range of options are not considered.(8)

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BIOGRAPHIES

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The author received his graduate training from the University of Toledo (1971, M.A. in Economics) and Virginia Polytechnic Institute and State University (1975, Ph.D. in Agricultural Economics). In between, he spent almost two years (1974-75) with the Office of Pesticide Programs, U.S. Environmental Protection Agency. He is currently an economist with the Economic Development Division, Economic Research Service, U.S. Department of Agriculture.

Although his initial training was oriented toward natural resource/regional economics, his interests

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The author received his Ph.D. in sociology from the University of Maryland in 1971. The major thrust of his educational preparation was in social psychology, and the sociology of complex organizations. His professional experience has ranged over a variety of interest areas in both academic and public policy research/analysis settings. He was staff member of the Social Science Research Center, Mississippi State University--1967-1969; an assistant professor at Old Dominion University in Norfolk, Virginia--1972-1974; and at present he is a senior staff sociologist with the Office of Pesticide Programs, Environmental Protection Agency..

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*The views expressed here are solely the authors and are not endorsed by either the USDA or the EPA.